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C&EN's Top

50 Chemical Products & 100 Chemical Producers

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News of the Week

■ **Trace gases other than carbon dioxide could exert a greater greenhouse effect on Earth's climate, researchers warn.** Page 6

■ **Presidential commission recommends replacing current chemical weapons with binaries but Congressmen say panelists were biased.** Page 7

■ **Wolfgang Hilger becomes chairman of Hoechst.** Page 7

■ **NAS move to renew scientific research exchanges with U.S.S.R. meets opposition.** Page 8

■ **More than 6000 attended ACS national meeting in Miami Beach.** Page 8

■ **Photographer snaps palm trees, people at ACS meeting.** Page 9

■ **Society's new Computer Secretariat will coordinate planning of computer-oriented activities of five ACS divisions.** Page 10

■ **PCBs are undergoing biodegradation in nature but PAHs may have caused heretofore undetected environmental harm.** Page 10

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Technology

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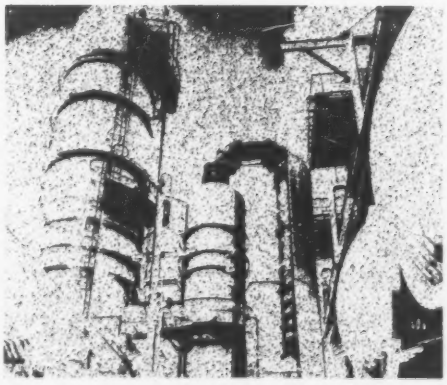
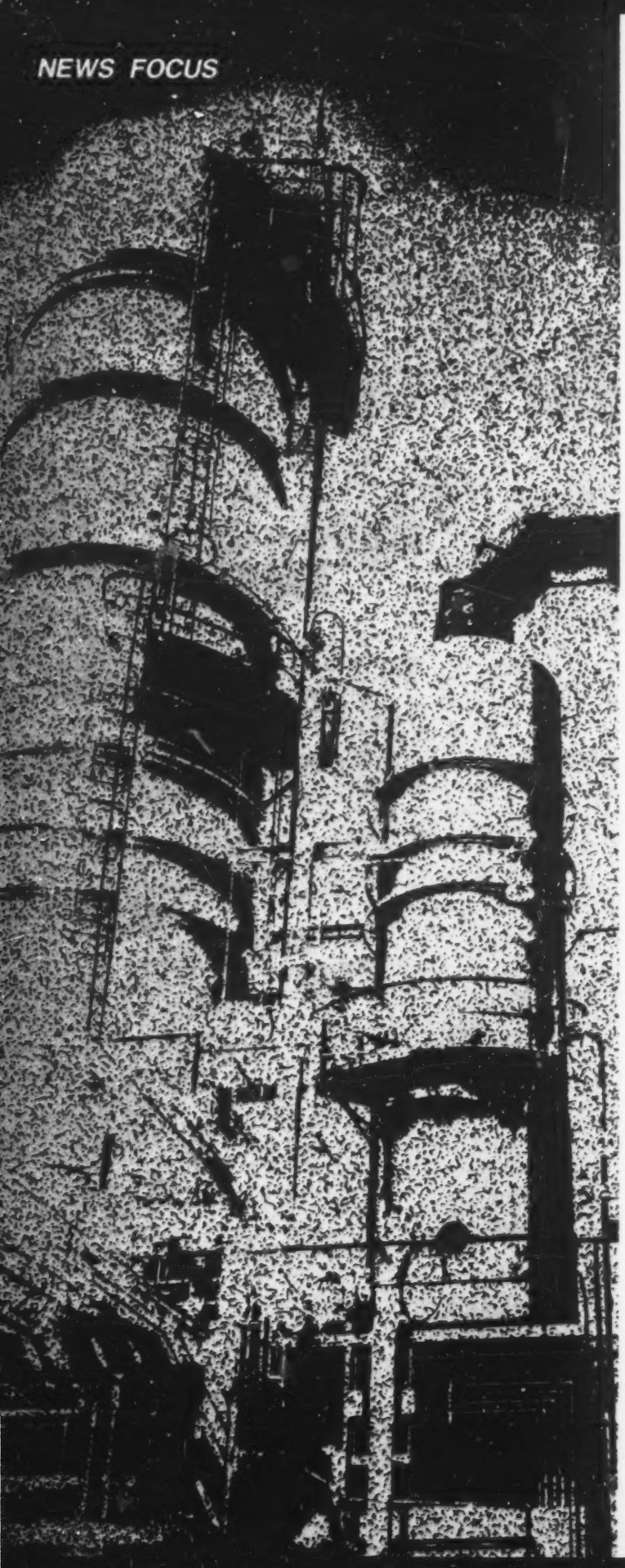
Priestley Medalist Henry Taube reminisces about mentor William C. Bray, pioneer of inorganic reaction kinetics studies. **Page 40**



News Focus

C&EN's Top 50 products, Top 100 producers chalk up a good year for 1984; production volumes increased and operating profits soared. **Page 11**



C&EN's Top 50 Chemical Products & 100 Chemical Producers

As 1984 began, a full year after the end of the previous economic recession, chemical producers were in full gear. And although the economy tailed off after the first six months, 1984 was, all in all, a good year for the chemical industry.

That is not to say the year was trouble free. Producers had to contend with the effects of the unprecedented strength of the dollar against foreign currencies. Imports increased sharply in many areas, and export markets fled American products for those priced in cheaper currencies. And less expensive imports kept producers from raising prices.

Still, production volumes increased handily. Output of C&EN's Top 50 chemical products jumped 9.2% overall in 1984 from the year before. Organics output rose 9.2%; that of inorganics climbed 9.4% last year.

Because of the intransigence of many product prices, however, the jump in output did not bring with it as big an increase in sales revenues. For C&EN's Top 100 chemical producers, sales totals increased only 7% in 1984 from 1983. At the same time, efficiency measures paid off: Operating profits soared an impressive 41% last year.

C&EN's Top 50 Chemical Products

Basic chemical production grew strongly in 1984

David Webber
C&EN New York

Production of basic chemicals returned to solid growth in almost all categories last year. The composite increase in output of C&EN's Top 50 chemicals, which includes both organics and inorganics, totaled some 9.2%, compared with 7.4% in 1983.

All in all, business in the second full year after the last recession ended in late 1982 was good enough to bring most of the stragglers—those products that were unable to reverse their production slump in 1983—into positive growth again. In 1983, for example, the first year of economic recovery, only 36 of the Top 50 chemicals recorded production gains. Last year, by comparison, all but five of the largest-volume products had increases in output. And those were chemicals that for the most part have been declining for the past decade because of long-term problems in their individual industry segments.

Nevertheless, the overall growth in production was not enough to raise totals to the levels reached in 1979, still the peak year historically for chemical output. Five-year compound growth (the base period for which is the big 1979 year) remained negative for both the entire Top 50 group and its two subcategories, organics and inorganics. In fact, the last year in which Top 50 output was higher than in the comparable period five years earlier was 1981. Between 1979 and 1984, production of the Top 50 chemicals declined at an average rate of 1.1%—organics output fell 0.4% per year and inorganics output fell 1.4% per year, on a compounded annual basis.

The overall negative performance of chemical production during the past five years reflects the topsy-

About the Top 50 list of chemical products

Government data, trade association figures, and industry estimates all go into preparing C&EN's annual list of the Top 50 chemical products, ranked by production volume. The federal government is relied upon most heavily, but when government figures are not available, other sources, primarily trade associations, are used. Industry sources and C&EN estimates are used only when other data are lacking.

Government data are not always accurate—they are only as good as the information that individual companies report. But they are an objective measure of production extending back for many years. Therefore, relatively accurate indications of growth can be made on a consistent basis.

At this time of year, C&EN has access only to preliminary reports of production for 1984. When the government and trade associations issue their final reports, the outcome can be changed, sometimes dramatically. As a result, production figures for earlier years that appear in the table on page 13 are different in some cases from those published in last year's Top 50 report. The final reports also can affect the rankings of chemicals. The 1983 rankings of eight of the chemicals listed in the table, for example, are different from those in the similar table published by C&EN a year ago.

The list itself covers production figures for the U.S. and includes chemicals produced for export. Candidates for the list include all basic, intermediate, and chemically homogeneous finished products. These range from chemical building blocks like ethylene and propylene to downstream products like vinyl acetate and ethylene glycol. This year methyl *tert*-butyl ether (MTBE) is included for the first time. Synthetic ethanol, number 50 last year, has been dropped.

The roster also includes basic inorganic chemicals, but does not include what C&EN considers to be minerals, such as salt, gypsum, and sulfur. Lime is included because it is processed and has many chemical and industrial applications. Refractory (dead-burned) dolomite is excluded in the calculation of lime production.

In the organics list, such petrochemical feedstocks as ethane, butane, and propane are excluded arbitrarily, because they are considered to be products of oil companies and because they have many nonchemical uses.

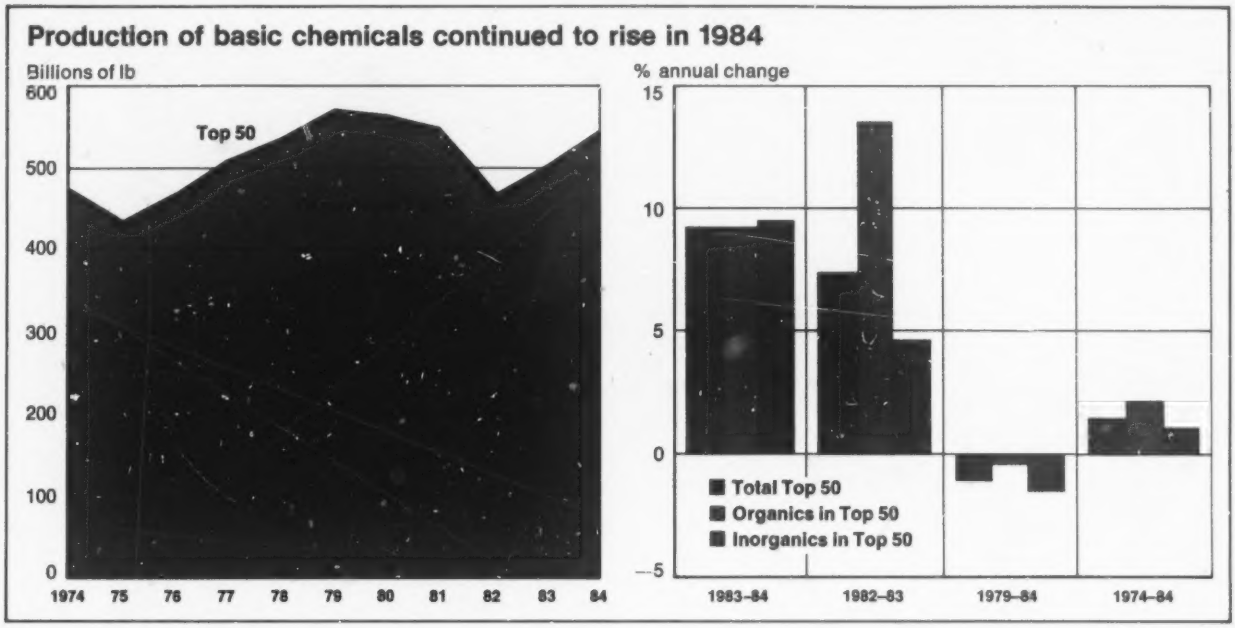
There are other gray areas besides lime and petrochemical feedstocks. For example, the basic aromatics—benzene, toluene, and xylene—are included. Admittedly, this makes the list less pure chemically.

Production figures are published by the government and trade associations in a variety of units—millions of pounds, thousands of tons, billions of cubic feet, millions of gallons, metric tons. To provide an accurate ranking and to make comparison of production volumes easier, C&EN not only gives production in common units but converts production to billions of pounds as well.

Top 50 chemical production increased 9% in 1984

Rank 1984	Rank 1983[a]		Billions of lb 1984	Billions of lb 1983	Common units[b] 1984	Common units[b] 1983	Average annual growth 1983–84	1982–83	1979–84	1974–84
1	1	Sulfuric acid	79.37	73.17	39,683 tt	36,583 tt	8.5%	10.1%	−1.7%	1.6%
2	2	Nitrogen	43.41	40.58	599 bcf	560 bcf	7.0	15.9	7.0	9.4
3	6	Ammonia	32.41	28.14	16,204 tt	14,072 tt	15.2	−10.9	−2.8	0.3
4	3	Lime[c]	32.20	29.73	16,100 tt	14,867 tt	8.3	5.6	−5.1	−2.3
5	4	Ethylene	31.18	28.68	31,178 mp	28,677 mp	8.7	17.0	0.8	2.7
6	5	Oxygen	31.04	28.39	375 bcf	343 bcf	9.3	−1.7	−3.8	0.4
7	7	Sodium hydroxide	22.45	20.46	11,224 tt	10,230 tt	9.7	9.0	−2.6	0.0
8	9	Phosphoric acid	22.22	19.53	11,111 tt	9,767 tt	13.8	18.3	1.5	4.4
9	8	Chlorine	21.45	19.92	10,724 tt	9,960 tt	7.7	8.5	−2.6	0.0
10	10	Sodium carbonate[d]	17.02	16.93	8,511 tt	8,467 tt	0.5	8.3	0.6	1.2
11	12	Nitric acid	16.08	13.94	8,041 tt	6,968 tt	15.4	−5.7	−2.0	0.1
12	11	Propylene	15.47	13.96	15,470 mp	13,959 mp	10.8	11.4	1.7	4.0
13	14	Urea[e]	14.30	12.27	7,148 tt	6,137 tt	16.5	−5.1	0.4	6.9
14	13	Ammonium nitrate[f]	14.01	12.48	7,005 tt	6,240 tt	12.3	−12.0	−3.3	0.7
15	15	Ethylene dichloride	13.73	11.51	13,731 mp	11,506 mp	19.3	51.0	3.1	4.1
16	16	Benzene	9.86	9.08	1,339 mg	1,233 mg	8.5	17.2	−4.3	−1.0
17	18	Ethylbenzene	8.61	7.88	8,613 mp	7,876 mp	9.4	18.3	0.4	3.6
18	17	Methanol	8.28	7.98	8,280 mp	7,982 mp	3.7	5.7	2.4	1.9
19	19	Carbon dioxide[g]	7.80	7.76	3,898 tt	3,880 tt	0.5	1.6	5.5	8.0
20	21	Styrene	7.71	6.80	7,706 mp	6,802 mp	13.3	14.5	0.6	2.6
21	20	Vinyl chloride	7.51	6.88	7,513 mp	6,875 mp	9.3	40.2	3.3	2.9
22	26	Xylene	6.12	5.23	850 mg	726 mg	17.1	10.3	−2.6	0.6
23	23	Terephthalic acid[h]	6.05	5.53	6,047 mp	5,626 mp	7.5	16.2	0.4	3.6
24	24	Ethylene oxide	5.96	5.53	5,957 mp	5,534 mp	7.6	11.0	0.7	3.4
25	27	Hydrochloric acid	5.72	4.84	2,862 tt	2,420 tt	18.3	−1.2	−1.5	1.5
26	25	Formaldehyde[i]	5.71	5.47	5,712 mp	5,465 mp	4.5	13.5	−0.9	−0.1
27	22	Toluene[j]	5.27	5.66	726 mg	780 mg	−6.9	9.2	−6.4	−2.4
28	28	Ethylene glycol	4.84	4.43	4,842 mp	4,425 mp	9.4	2.7	0.5	3.8
29	29	*p*-Xylene	4.27	4.11	4,268 mp	4,114 mp	3.7	28.3	−1.7	4.7
30	30	Ammonium sulfate	4.13	3.91	2,063 tt	1,956 tt	5.5	10.6	−2.7	−0.3
31	32	Potash[k]	3.53	3.15	1,600 tmt	1,429 tmt	12.0	−19.9	−6.4	−4.6
32	31	Cumene	3.36	3.35	3,360 mp	3,345 mp	0.4	21.9	−3.0	1.5
33	35	Carbon black	2.89	2.50	2,893 mp	2,496 mp	15.9	8.4	−2.8	−1.5
34	34	Phenol[l]	2.85	2.64	2,845 mp	2,637 mp	7.9	30.4	−0.9	2.0
35	33	Acetic acid	2.64	2.81	2,642 mp	2,807 mp	−5.9	2.1	−4.1	0.2
36	36	Butadiene[m]	2.53	2.35	2,531 mp	2,353 mp	7.6	22.9	−6.7	−3.7
37	38	Acrylonitrile	2.20	2.15	2,201 mp	2,146 mp	2.6	5.5	1.8	4.5
38	37	Aluminum sulfate	2.16	2.21	1,079 tt	1,103 tt	−2.2	−4.3	−3.9	−1.5
39	44	Cyclohexane	2.13	1.66	2,130 mp	1,656 mp	28.6	29.9	−2.6	−1.0
40	42	Calcium chloride[n]	2.10	1.71	1,049 tt	857 tt	22.4	0.5	1.3	−0.5
41	39	Vinyl acetate	2.02	1.96	2,023 mp	1,963 mp	3.1	4.6	0.4	3.7
42	41	Propylene oxide	1.90	1.80	1,900 mp	1,800 mp	5.6	7.1	−3.3	0.8
43	40	Acetone	1.89	1.86	1,887 mp	1,859 mp	1.5	9.7	−6.6	−0.5
44	43	Sodium sulfate[o]	1.74	1.71	872 tt	854 tt	2.1	−1.2	−4.9	−4.3
45	45	Titanium dioxide	1.60	1.51	799 tt	757 tt	5.5	15.2	1.5	0.2
46	46	Sodium silicate	1.50	1.46	750 tt	728 tt	3.0	9.6	−1.6	−0.3
47	—	Methyl *tert*-butyl ether[p]	1.47	0.84	1,469 mp	839 mp	75.1	1.8	nm	nm
48	48	Adipic acid	1.39	1.28	1,390 mp	1,280 mp	8.6	10.6	−4.4	−0.6
49	47	Sodium tripolyphosphate	1.33	1.34	667 tt	669 tt	−0.3	2.8	−2.5	−3.0
50	49	Isopropyl alcohol	1.15	1.21	1,147 mp	1,209 mp	−5.1	−12.4	−9.6	−5.1
		TOTAL ORGANICS	**180.39**	**164.97**			**9.2%**	**13.5%**	**−0.4%**	**2.2%**
		TOTAL INORGANICS	**366.15**	**335.38**			**9.4%**	**4.7%**	**−1.4%**	**1.1%**
		GRAND TOTAL	**546.54**	**500.35**			**9.2%**	**7.4%**	**−1.1%**	**1.4%**

a Revised. b tt = thousands of tons, bcf = billions of cubic feet, mp = millions of pounds, mg = millions of gallons, tmt = thousands of metric tons. c Except refractory dolomite. d Synthetic and natural. e 100% basis. f Original solution. g Liquid and solid only. h Includes both acid and ester without double counting. i 37% by weight. j All grades. k K_2O basis. l Synthetic only. m Rubber grade. n Solid and liquid. o High and low purity. p First year in which qualified for inclusion in Top 50; ethanol has been excluded. nm = not meaningful. **Sources:** Bureau of the Census, Bureau of Mines, International Trade Commission, C&EN estimates



turvy nature of the nation's economy during the early 1980s. The general maturity of the basic chemicals industry is reflected even more in composite growth figures for the past 10 years. Since 1974, the entire group's production has increased at a compound annual rate of just 1.4%. Inorganics output grew just 1.1% per year and organics output 2.2% per year over that span. And the decline is widespread: 17 of the Top 50 chemicals recorded lower production in 1984 than in 1974. Output of another 10 products has grown at an annual compound rate of less than 1% over the past decade.

Still, there were some impressive gains made in 1984 compared with 1983. Of the Top 50 group, 15 products recorded production increases of more than 10%. The greatest growth was registered by one of the smallest of the group: methyl *tert*-butyl ether (MTBE), output of which was 75% higher than in 1983. MTBE, which five years ago was not produced in enough volume to merit even an individual line entry in the International Trade Commission's annual compendium of synthetic organic chemicals production, was elevated into the Top 50 group for the first time in 1984, thanks to its increasing use in gasoline and the bringing on stream of a number of new MTBE production facilities.

The inclusion of MTBE displaced synthetic ethanol, which finally managed to shrink itself off the list. Ethanol production increased in each of the past two years—up 2.9% in the 1983–84 period and up 5.3% in the 1982–83 period. However, over the past decade, the product has been one of the fastest decreasing chemicals, at an annual compound decline of 3.7%.

After MTBE, the next biggest production gains in 1984 compared to 1983 were recorded by (in order) cyclohexane, up 29%; calcium chloride, up 22%; ethylene dichloride, up 19%; and hydrochloric acid, up 18%. The five worst performers in terms of output were: toluene, battered by the slumping gasoline business and competition from MTBE, down 6.9%; acetic acid, down 5.9%; isopropyl alcohol, down 5.1%; aluminum sulfate, down 2.2%; and sodium tripolyphosphate, down less than 1%.

The picture for production changes over the past 10 years is somewhat different. Over that span, the best performer has been nitrogen, output of which grew between 1974 and 1984 at an average annual rate of 9.4%. Next best was another industrial gas, carbon dioxide; output of liquid and solid forms of carbon dioxide increased at a compound rate of 8%. Following were urea, up 6.9% per year; *p*-xylene, up 4.7% per year; and acrylonitrile, up 4.5% per year over the past decade.

Over the past 10 years, the greatest declines in production have been registered by isopropyl alcohol, output of which has plunged at an average annual rate of 5.1%; potash, down 4.6% per year; sodium sulfate, down 4.3% per year; butadiene, despite two annual production increases in a row for synthetic rubber, down 3.7% per year; and sodium tripolyphosphate, down 3% per year. There are no real surprises in the group: All were in the five worst category in 1983 as well, with the exception of sodium tripolyphosphate, which would have been had ethanol been excluded from that dubious honor.

There were many changes in ranking between 1983 and 1984, but most of them involved no more than the transposition of two products on sequential echelons. The most notable differences were ammonia, which jumped from sixth place in 1983 to third last year; xylene, which climbed from 26 to 22; toluene, which dropped from 22 to 27; cyclohexane, which rose from 44 to 39; and acetone, which fell from 40 in 1983 to 43 last year. □

C&EN's Top

100

Chemical Producers

Sales, profits rose for largest chemical producers

William J. Storck
C&EN New York

Chemical producers generally did well last year. Both sales and operating profits were up despite lower prices, foreign competition in both domestic and export markets because of the high value of the dollar, and a rather lackluster capacity use picture. Granted, chemical executives had more to complain about as 1984 ground on, but overall, results were fairly impressive, especially when compared with those for prior years.

A number of end-use markets turned up for producers, chiefly autos and housing. However, the one that made the most difference for many companies was agriculture. In 1984, the government's payment-in-kind crop set-aside program was all but ended, providing rapidly increasing markets for all agricultural chemicals—pesticides and fertilizers—as farmers were once again increasing planted acreage.

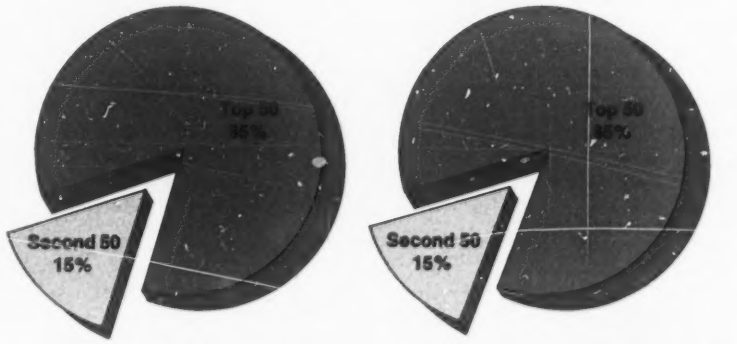
Thus, with market opportunities increasing as opposed to the past few years, the number of producers with declining sales from chemicals were few. Of the companies on C&EN's list of the Top 100 chemical producers (in terms of sales from chemical operations), only 14 registered a decline in chemical sales in 1984 from the year before. Sales from chemicals for the companies grew almost 8% in 1984 to $127 billion. In the combined listing for 1983, 34 producers had declines in chemical sales from the year before.

Operating profits from chemicals also increased last year with the growth dwarfing that for sales. Chemical operating profits (generally sales minus administrative costs and costs of goods) for the companies that reported this figure increased an average of 41% from 1983 to $11.0 billion.

Once again, Du Pont is the U.S.'s largest chemical producer, with about $12.0 billion in chemical sales, up 3.4% from the year before. In fact, Du Pont typifies the stability of the top 10 producers. All of the first 10 for 1984 comprised the top 10 for 1983. There is no change in ranking until six on the list. For 1984, Shell, which had been ranked seven in 1983, traded places with Celanese, which had been six that year. The other change in the first 10 is Atlantic Richfield, which moved up two notches to eight, and Standard Oil (Ind.), now Amoco Corp., fell from eighth place, replacing Arco as 10 on the list.

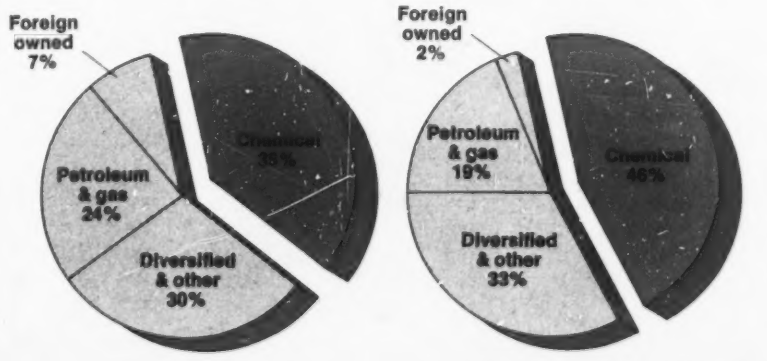
There are a number of firsts associated with this year's listing. Although C&EN has been ranking the Top 100 for several years, this is the first time that the listing has been put together in one issue.

Larger companies dominate chemical sales, earnings...



1984 sales = $127 billion — 1984 operating profits = $11 billion

...and among types of firms, chemicals perform best



1984 sales = $127 billion — 1984 operating profits = $11 billion

Operating results improved for most chemical producers in 1984

Rank 1984	Rank 1983	Company	Chemical sales 1984 ($ millions)	Change from 1983	Chemical sales as % of total sales	Industry classification	Chemical operating profits 1984[a] ($ millions)	Change from 1983	Chemical operating profits as % of total operating profits	Operating profit margin[b]	Identifiable chemical assets 1984 ($ millions)	Chemical assets as % of total assets	Operating return on chemical assets[c]
1	1	Du Pont	$12,005	3.4%	32.3%	Diversified	$1107	−3.2%	25.4%	9.2%	$7538	34.3%	14.7%
2	2	Dow Chemical	9,591	8.1	77.7	Basic chemicals	741	29.3	87.4	7.7	7645	66.9	9.7
3	3	Exxon	6,870	7.5	6.7	Petroleum	677	80.1	6.5	9.9	5246	8.3	12.9
4	4	Monsanto	5,951[d]	7.6	82.6	Basic chemicals	669	35.7	98.8	11.2	5054	79.3	13.2
5	5	Union Carbide	4,158	6.3	41.1	Basic chemicals	480	74.5	49.3	11.5	4683	46.4	10.2
6	7	Shell Oil	3,383	4.8	13.6	Petroleum	273	110.0	8.5	8.1	3624	15.3	7.5
7	6	Celanese	3,328	2.1	98.0	Basic chemicals	272	27.1	100.0	8.2	3104	100.0	8.8
8	10	Atlantic Richfield	3,144	23.3	10.3	Petroleum	148	131.3	3.9	4.7	2616	11.8	5.7
9	9	W. R. Grace	2,848	3.2	41.0	Specialty chemicals	336	3.7	57.7	11.8	1779	36.3	18.9
10	8	Amoco Corp.	2,834	−2.5	10.0	Petroleum	349	101.7	8.2	12.3	2249	9.6	15.5
11	12	Mobil	2,607	11.8	3.9	Petroleum	56	def	1.1	2.1	2258	5.7	2.5
12	13	Eastman Kodak	2,464	7.8	21.1	Photo equipment	281	31.3	18.2	11.4	2054	19.1	13.7
13	11	Allied	2,433	4.1	21.8	Diversified	231	3.1	17.2	9.5	1345	16.4	17.2
14	14	Phillips Petroleum	2,351	4.3	14.5	Petroleum	221	166.3	8.9	9.4	1498	8.8	14.8
15	—	General Electric	2,117	7.8	6.8	Electrical products	470	42.9	12.1	22.2	2362	9.6	19.9
16	16	Rohm & Haas	1,962	8.5	88.5	Basic chemicals	333	11.7	103.4	17.0	1293	95.2	25.8
17	18	American Cyanamid	1,838	10.4	44.6	Basic chemicals	125	27.0	38.4	7.1	1273	53.7	10.6
18	15	Hercules	1,823	−9.2	78.1	Basic chemicals	129	6.6	61.4	7.1	1335	78.9	9.7
19	20	Air Products[e]	1,60[illegible]	13.7	81.3	Basic chemicals	292	49.2	107.1	18.2	1731	74.3	16.9
20	25	Ciba-Geigy	1,5[illegible]9	21.0	54.6	Specialty chemicals	na	na	na	na	na	na	na
21	29	Texaco	1,538	35.3	2.4	Petroleum	39	def	1.0	2.5	1008	3.0	3.9
22	21	Stauffer Chemical[e]	1,504	12.2	89.1	Basic chemicals	129	def	100.0	8.6	1601	100.0	8.1
23	27	Ashland Oil	1,501	24.3	13.5	Petroleum	55	5400.0	21.8	3.7	503	14.6	10.9
24	22	Mobay	1,500	15.4	86.7	Basic chemicals	135[f]	103.9	100.0	9.0	na	na	na
25	26	American Hoechst	1,468[d]	20.1	69.4	Basic chemicals	na	na	na	na	na	na	na
26	24	Borden	1,448	11.8	28.4	Dairy products	170	23.5	41.2	11.7	1340	48.6	12.7
27	30	B. F. Goodrich	1,424	25.7	34.6	Rubber products	114	157.8	68.6	8.0	1366	56.5	8.4
28	32	U. S. Steel	1,365	21.0	5.9	Steel	57	def	3.6	4.2	613	3.5	9.3
28	19	Ethyl	1,365[g]	−7.7	88.2	Basic chemicals	190	21.6	85.2	13.9	790	80.8	24.0
30	31	Unocal Corp.	1,249	10.3	9.8	Petroleum	87[f]	18.1	12.5	7.0	747	7.3	11.7
31	23	FMC	1,236	−4.7	38.8	Machinery	187	10.6	47.5	15.1	985	53.4	19.0
32	35	BASF Wyandotte	1,185	14.6	67.3	Basic chemicals	34	72.2	100.0	2.9	na	na	na
33	33	Olin	1,174	5.6	53.8	Basic chemicals	61	−10.6	35.1	5.2	1021	62.9	5.9
34	34	Standard Oil of Calif.	1,100	3.9	3.8	Petroleum	11[f]	def	0.7	1.0	847	4.2	1.3
35	42	National Distillers	1,081	37.6	35.0	Alcoholic beverages	102	49.5	50.0	9.4	763	40.4	13.3
36	38	PPG Industries	993	12.6	20.8	Glass products	122	63.1	20.9	12.3	1150	35.8	10.6
37	28	Occidental Petroleum	985[g]	−13.4	7.0	Petroleum	69	def	4.2	7.0	991	8.1	6.9
38	36	International Minerals[h]	977	−1.9	63.5	Agrichemicals	146	−6.6	63.0	14.9	1323	67.3	11.0
39	40	Borg-Warner	944	14.3	21.1	Auto equipment	121	10.1	31.3	12.8	376	20.3	32.3
40	39	CF Industries	908[d]	5.3	94.9	Agrichemicals	54	58.4	100.0	6.0	1014	100.0	5.4
41	57	Koppers	885	8.2	45.0	Diversified	18	−15.4	22.9	2.0	468	43.3	3.8
42	43	Dow Corning	855	12.0	89.3	Specialty chemicals	91[f]	33.0	100.0	10.6	na	na	na
43	41	Lubrizol	832	5.3	94.9	Specialty chemicals	102	3.7	100.0	12.3	702	100.0	14.6
44	45	Williams Cos.	831	12.3	21.8	Agrichemicals	68	9628.6	17.7	8.2	932	20.6	7.3
45	37	Diamond Shamrock	820	−12.9	21.0	Petroleum	116	869.2	22.9	14.2	764	14.2	15.2
46	44	Reichhold Chemicals	801	7.2	93.3	Basic chemicals	44	26.1	100.0	5.4	361	100.0	12.1
47	58	Farmland Industries	783	44.5	10.3	Agricultural supplies	32	def	27.6	4.1	447	37.0	7.1
48	46	Eli Lilly	757	4.1	23.4	Drugs	108	10.0	13.2	14.2	773	21.2	13.9
49	48	Badische	709	5.6	94.7	Basic chemicals	33	11.2	100.0	4.6	518	100.0	6.3
50	56	Standard Oil (Ohio)	707	24.9	4.6	Petroleum	44	def	1.5	6.2	664	3.8	6.6

Rank 1984	Rank 1983	Company	Chemical sales 1984 ($ millions)	Change from 1983	Chemical sales as % of total sales	Industry classification	Chemical operating profits 1984[a] ($ millions)	Change from 1983	Chemical operating profits as % of total operating profits	Operating profit margin[b]	Identifiable chemical assets 1984 ($ millions)	Chemical assets as % of total assets	Operating return on chemical assets[c]
51	52	Uniroyal	372	13.3	27.9	Rubber products	110	69.0	47.5	16.4	443	39.0	24.9
52	49	Nalco Chemical	664	0.7	99.3	Specialty chemicals	115	−2.0	100.0	17.3	479	100.0	24.0
53	51	Pennwalt	656	6.3	57.8	Basic chemicals	52	19.8	66.4	7.9	506	69.9	10.2
54	65	Morton Thiokol[h]	654	45.9	22.4	Diversified	81	72.0	35.2	12.4	497	43.0	16.3
55	50	Merck	642	6.0	17.0	Drugs	78	49.3	9.7	12.2	596	16.8	13.1
56	55	Witco Chemical	623	9.0	38.2	Specialty chemicals	65	20.7	41.7	10.5	271	35.8	24.1
57	59	National Starch	561	10.5	60.3	Specialty chemicals	na	na	na	na	na	na	na
58	82	Engelhard	560	−1.1	22.6	Specialty metals	66	−7.9	58.7	11.8	442	51.2	14.9
59	63	Cabot[e]	542	17.8	26.3	Specialty metals	67	53.9	31.6	12.4	281	16.1	24.0
60	67	Kerr-McGee	520	18.5	12.4	Petroleum	−25	def	def	def	580	16.0	def
61	66	Freeport-McMoRan	493	11.9	52.3	Agrichemicals	110	47.8	87.3	22.2	220	11.5	49.8
62	62	International Flavors	477	3.4	96.7	Specialty chemicals	116	4.6	100.0	24.3	368	100.0	31.5
63	60	NL Industries	473	0.6	34.5	Petroleum services	95	50.8	91.1	20.1	283	21.6	33.5
64	68	Polysar	464	6.5	93.9	Basic chemicals	na	na	na	na	na	na	na
65	69	H. B. Fuller[i]	447	4.9	95.3	Specialty chemicals	32	−3.4	100.0	7.2	226	100.0	14.2
66	47	Georgia-Pacific	448	−34.7	9.6	Wood products	−134	def	def	def	158	3.3	def
67	70	Henkel	430	7.5	93.0	Specialty chemicals	na	na	na	na	na	na	na
68	72	Liquid Air	426	9.3	77.7	Basic chemicals	52	6.6	96.3	12.2	na	na	na
69	61	Sun Co.	422	−9.0	3.0	Petroleum	na	na	na	na	na	na	na
70	73	InterNorth	396	5.7	5.0	Natural gas	47	76.8	8.1	11.9	636	10.8	7.4
71	71	Pfizer	377	−4.4	10.2	Drugs	5	−10.0	0.5	1.2	382	9.4	1.2
72	81	Rhône-Poulenc	370	27.6	78.4	Specialty chemicals	na	na	na	na	na	na	na
72	90	Terra Chemicals	370	30.7	76.5	Agrichemicals	na	na	na	na	na	na	na
74	89	SCM[h]	361[d]	43.9	12.5	Paint	37	144.3	32.4	10.2	317	27.3	11.6
75	74	GAF	357	10.5	44.2	Specialty chemicals	79	22.3	87.2	22.1	204	45.1	38.8
76	78	Soltex	350	16.7	85.7	Basic chemicals	na	na	na	na	na	na	na
77	84	Mississippi Chemical[h]	349	32.8	75.3	Farm cooperative	4	−2.9	100.0	1.2	352	100.0	1.2
78	77	Tyler	346	13.6	32.8	Diversified chemical	7	−67.3	22.9	2.1	160	33.2	4.5
79	79	Big Three Industries	339	15.6	37.8	Petroleum services	76	6.8	62.0	22.3	576	49.9	13.1
80	80	Upjohn	325	11.7	13.4	Drugs	−9	def	def	def	191	8.5	def
81	88	Chemed	318	26.2	72.7	Specialty chemicals	42	20.2	90.4	13.1	151	85.5	27.7
81	75	American Petrofina	318	2.5	14.6	Petroleum	20	293.1	38.1	6.4	308	18.8	6.6
83	86	Vulcan Materials	302	18.1	26.0	Nonmetallic minerals	47	224.0	35.8	15.6	na	na	na
84	83	Petrolite[i]	284	6.6	90.7	Specialty chemicals	41	23.5	105.2	14.2	160	72.4	25.2
85	93	Great Lakes Chemicals	278	23.1	81.2	Specialty chemicals	57	44.2	100.0	20.3	284	100.0	19.9
86	91	Aluminum Co. of America	273	13.5	4.2	Nonferrous metals	na	na	na	na	na	na	na
86	92	Ferro	273[d]	13.4	36.2	Specialty materials	16	−3.8	31.7	5.8	140	42.5	11.2
88	87	Baker Industries	264	4.5	95.7	Agrichemicals	16	1521.4	100.0	6.1	341	100.0	4.8
89	85	Emhart	261	1.0	14.4	Machinery	23	−4.6	10.9	8.7	111	11.5	20.5
90	53	Kaiser Aluminum	249	−57.3	18.2	Nonferrous metals	39	58.6	67.0	15.6	281	8.0	13.8
91	94	Loctite	242	12.0	89.3	Specialty chemicals	43	48.0	100.0	17.8	227	100.0	18.9
92	96	Stepan Chemical	235	13.4	88.2	Specialty chemicals	6	−45.0	100.0	2.6	134	100.0	4.6
93	—	Northwest Industries	216	2.5	14.7	Diversified	27	13.2	11.9	12.3	163	10.7	16.2
94	97	Essex Chemical	176	4.2	95.9	Basic chemicals	27	59.3	100.0	15.4	111	100.0	24.4
95	98	Agway	166	2.1	4.0	Farm cooperative	na	na	na	na	na	na	na
96	—	First Mississippi	165	52.5	40.1	Agrichemical	28	37.3	64.6	17.2	82	25.9	34.6
97	100	Sterling Drug	145	6.1	7.5	Diversified	9	21.6	3.4	6.0	118	8.1	7.4
98	—	Crompton & Knowles	115	−1.6	60.9	Specialty chemicals	14	5.9	64.3	11.8	68	56.3	20.1
99	—	Avon Products	114	10.4	3.3	Diversified	17	37.7	4.5	14.8	156	6.4	10.7
100	99	UGI Corp.	113	−24.0	22.2	Natural gas	1	def	1.2	0.7	125	22.1	0.6

a Operating profit defined as sales less administrative expense and cost of sales. b Operating profit from chemicals as a percentage of total operating profits. c Operating profit as a percentage of identifiable chemical assets. d Chemical sales include significant amounts of nonchemical products. e Fiscal year ended Sept. 30. f Chemical net profits. g Does not include all chemical profits. h Fiscal year ends June 30. i Fiscal year ends Nov. 30. j Fiscal year ends Oct. 31. na = not available. def = deficit.

C&EN's Top 100 chemical producers are ranked five ways

	Chemical sales			Chemical operating profits			Chemical operating profit margin			Identifiable chemical assets			Return on chemical assets		
		Rank			Rank			Rank			Rank			Rank	
$ Millions	1984	1984	1983	1984	1984	1983	1984	1984	1983	1984	1984	1983	1984	1984	1983
Agway	$ 166	95	98	na	—	—	na	—	—	na	—	—	na	—	—
Air Products	1,604	19	20	$ 292	10	11	18.2%	8	11	$1731	14	13	16.9%	24	30
Allied	2,433	13	11	231	14	8	9.5	45	30	1345	18	18	17.2	23	17
Aluminum Co. of America	273	86	91	na	—	—	na	—	—	na	—	—	na	—	—
American Cyanamid	1,898	17	18	135	21	22	7.1	58	50	1273	23	19	10.6	49	44
American Hoechst	1,468	25	26	na	—	—	na	—	—	na	—	—	na	—	—
American Petrofina	318	81	76	20	71	69	6.4	61	71	308	60	77	6.6	65	64
Amoco Corp.	2,834	10	8	349	7	12	12.3	28	52	2249	11	9	15.5	27	47
Ashland Oil	1,501	23	27	55	49	72	3.7	73	76	503	46	57	10.9	47	71
Atlantic Richfield	3,144	6	10	148	19	35	4.7	69	66	2616	8	8	5.7	69	66
Avon	114	99	—	17	73	—	14.9	19	—	156	75	—	10.7	48	—
Badische	709	49	49	33	64	53	4.6	70	62	518	44	47	6.3	67	56
BASF Wyandotte	1,185	32	35	34	63	61	2.9	74	70	na	—	38	na	—	65
Baker Industries	264	88	88	16	74	72	6.1	63	75	341	58	65	4.8	71	70
Big Three Industries	339	79	80	76	39	29	22.3	2	1	576	43	45	13.1	39	28
Borden	1,448	26	24	170	18	16	11.7	38	25	1340	19	17	12.7	42	33
Borg-Warner	944	39	40	121	25	21	12.8	25	16	376	54	62	32.3	5	3
Cabot	542	59	64	67	42	42	12.4	26	31	281	63	69	24.0	13	18
Celanese	3,328	7	6	272	13	9	8.2	51	47	3104	7	7	8.8	56	46
CF Industries	908	40	39	54	50	49	6.0	64	64	1014	26	29	5.4	70	63
Chemed	318	81	89	42	58	46	13.1	24	12	151	76	82	27.7	7	5
Ciba-Geigy	1,560	20	25	na	—	—	na	—	—	na	—	—	na	—	—
Crompton & Knowles	115	98	—	14	76	—	11.8	35	—	68	84	—	20.1	17	—
Diamond Shamrock	820	45	37	116	26	66	14.2	20	73	764	34	25	15.2	28	69
Dow Chemical	9,591	2	2	741	2	2	7.7	56	48	7645	1	1	9.7	53	49
Dow Corning	855	42	44	na	—	—	—	—	36	na	—	—	na	—	—
Du Pont	12,005	1	1	1107	1	1	9.2	48	29	7538	2	2	14.7	31	20
Eastman Kodak	2,464	12	13	281	11	9	11.4	40	33	2054	12	11	13.7	36	34
Eli Lilly	757	48	47	108	32	24	14.2	20	13	773	33	36	13.9	34	29
Emhart	261	89	86	23	70	57	8.7	49	35	111	81	85	20.5	16	10
Engelhard	560	58	57	66	43	28	11.8	35	18	442	52	50	14.9	29	20
Essex Chemical	176	94	97	27	68	62	15.4	16	28	111	81	84	24.4	11	23
Ethyl	1,365	28	19	190	16	14	13.9	23	25	790	32	33	24.0	13	15
Exxon	6,870	3	3	677	3	4	9.9	44	55	5246	3	3	12.9	41	47
Farmland Industries	783	47	59	32	65	83	4.1	72	—	447	50	55	7.1	63	—
Ferro	273	86	92	16	74	62	5.8	66	42	140	77	87	11.2	45	8
First Mississippi	165	96	—	28	67	—	17.2	11	—	82	83	—	34.6	3	—
FMC	1,236	31	23	187	17	13	15.1	17	17	985	29	25	19.0	20	19
Freeport-McMoRan	493	61	67	110	30	27	22.2	3	6	220	68	70	49.8	1	2
H. B. Fuller	447	64	70	32	65	51	7.2	57	41	226	67	72	14.2	33	22
GAF	357	75	75	79	37	33	22.1	5	3	204	69	74	38.8	2	1
General Electric	2,117	15	—	470	6	—	22.2	3	—	2362	9	—	19.9	18	—
Georgia-Pacific	446	66	48	−134	85	35	def	—	33	158	74	28	def	—	54
B. F. Goodrich	1,424	27	30	114	29	42	8.0	54	66	1366	17	20	8.4	57	61
W. R. Grace	2,848	9	9	336	8	5	11.8	35	22	1779	13	14	18.9	21	12
Great Lakes Chemical	278	84	93	57	46	45	20.3	6	5	284	61	71	19.9	18	15
Henkel	430	67	71	na	—	—	na	—	—	na	—	—	na	—	—
Hercules	1,823	18	15	129	22	18	7.1	58	52	1335	20	21	9.7	53	36
International Flavors	477	62	63	116	26	20	24.3	1	2	368	55	56	31.5	6	6
International Minerals	977	38	36	146	20	14	14.9	18	9	1323	21	16	11.0	48	31

$ Millions	Chemical sales	Rank		Chemical operating profits	Rank		Chemical operating profit margin	Rank		Identifiable chemical assets	Rank		Return on chemical assets	Rank	
	1984	1984	1983	1984	1984	1983	1984	1984	1983	1984	1984	1983	1984	1984	1983
InterNorth	396	70	74	47	53	56	11.9	34	44	636	39	58	7.4	60	51
Kaiser Aluminum	249	90	54	39	60	57	15.6	14	63	281	63	49	13.8	35	59
Kerr-McGee	520	60	68	−25	84	81	def	—	—	580	42	43	def	—	—
Koppers	885	41	41	18	72	60	2.0	79	68	468	49	51	3.8	75	60
Liquid Air	426	68	73	52	51	40	12.2	32	19	na	—	52	na	—	32
Loctite	242	91	94	43	57	54	17.8	9	13	227	66	73	18.9	21	27
Lubrizol	832	43	42	102	33	23	12.3	28	18	702	37	40	14.6	32	24
Merck	642	55	51	78	38	39	12.2	32	38	596	41	44	13.1	39	41
Mississippi Chemical	349	77	85	4	81	71	1.2	80	72	352	57	64	1.2	77	67
Mobay	1,500	24	22	na	—	—	—	—	59	na	—	22	na	—	—
Mobil	2,607	11	12	56	48	79	2.1	77	—	2258	10	10	2.5	76	—
Monsanto	5,951	4	4	669	4	3	11.2	41	37	5054	4	5	13.2	38	34
Morton Thiokol	654	54	65	81	36	41	12.4	26	27	497	47	46	16.3	25	40
Nalco Chemical	664	52	50	115	28	19	17.3	10	4	479	48	48	24.0	13	7
National Distillers	1,031	35	43	102	33	30	9.4	46	38	763	35	40	13.3	37	37
National Starch	561	57	60	na	—	—	na	—	—	na	—	—	na	—	—
NL Industries	473	63	61	95	35	37	20.1	7	15	283	62	66	33.5	4	11
Northwest Industries	216	93	—	27	68	—	12.3	28	—	163	71	—	16.2	26	—
Occidental Petroleum	985	37	28	69	40	77	7.0	60	—	991	28	32	6.9	64	—
Olin	1,174	33	33	61	45	30	5.2	68	51	1021	25	31	5.9	68	50
Pennwalt	656	53	52	52	51	44	7.9	55	44	506	45	54	10.2	51	38
Petrolite	284	84	84	41	59	51	14.2	20	21	160	72	80	25.2	9	9
Pfizer	377	71	72	5	80	69	1.2	80	73	382	53	59	1.2	78	67
Phillips Petroleum	2,351	14	14	221	15	25	9.4	46	67	1498	16	15	14.8	30	55
Polysar	464	64	69	na	—	—	na	—	—	na	—	—	na	—	—
PPG Industries	993	36	38	122	24	26	12.3	28	40	1150	24	23	10.6	49	52
Reichhold Chemicals	801	46	45	44	55	46	5.4	67	61	361	56	61	12.1	43	36
Rhône-Poulenc	370	72	82	na	—	—	0.0	—	—	na	—	—	na	—	—
Rohm & Haas	1,962	16	16	333	9	6	17.0	12	7	1293	22	27	25.8	8	4
SCM	361	74	90	37	62	64	10.2	43	52	317	59	68	11.6	44	56
Shell Oil	3,383	6	7	273	12	17	8.1	53	64	3624	6	6	7.5	59	62
Soltex	350	76	79	na	—	—	na	—	—	na	—	—	na	—	—
Standard Oil (Ohio)	707	50	57	44	55	76	6.2	62	—	664	38	42	6.6	66	—
Standard Oil of Calif.	1,100	34	34	na	—	—	—	—	—	847	31	37	na	—	—
Stauffer Chemical	1,504	22	21	129	22	78	8.6	50	—	1601	15	12	8.1	58	—
Stepan Chemical	235	92	96	6	79	67	2.6	75	57	134	78	81	4.6	72	45
Sterling Drug	145	97	100	9	77	68	6.0	64	58	118	80	86	7.4	60	53
Sun Co.	422	69	62	na	—	—	na	—	—	na	—	—	na	—	—
Terra Chemicals	370	72	83	na	—	—	na	—	—	na	—	78	na	—	—
Texaco	1,538	21	28	39	60	84	2.5	76	—	1008	27	34	3.9	74	—
Tyler	346	78	78	7	78	59	2.1	77	42	160	73	79	4.5	73	36
UGI Corp.	113	100	99	1	82	75	0.7	82	—	125	79	83	0.6	79	—
Union Carbide	4,158	5	5	480	5	7	11.5	39	46	4683	5	4	10.2	51	58
Uniroyal	672	51	53	110	30	33	16.4	13	23	443	51	52	24.9	10	25
Unocal Corp.	1,249	30	30	na	—	—	—	—	48	747	36	39	na	—	—
Upjohn	325	80	81	−9	83	80	def	—	—	191	70	76	def	—	—
U.S. Steel	1,365	28	32	57	46	81	4.2	71	—	613	40	24	9.3	55	—
Vulcan Materials	302	83	87	47	53	64	15.6	14	56	na	—	—	na	—	—
Williams Cos.	531	44	46	68	41	72	8.2	51	76	932	30	35	7.3	62	72
Witco Chemical	623	56	56	65	44	38	10.5	42	31	271	65	67	24.1	12	13

Note: Companies with negative profitability and those giving only net profits are not included in these rankings. There are 85 companies ranked for operating profit and operating profit margin; 84 companies ranked by assets; and 79 ranked by return on assets. Companies not included in 1983's listing are not ranked for that year. na = not available. def = deficit.

Larger producers outperform smaller

For the second year in a row, the 50 larger chemical producers as a group outperformed the smaller firms in a number of areas.

Riding the wave of economic recovery in 1984, the 50 top producers, largely makers of cyclical large-volume commodity chemicals, saw sales, earnings, and profitability all rise, and in most cases rise faster than those for the 50 smaller producers.

Sales growth for the 50 larger companies averaged 7.7% in 1984 over 1983, whereas that for the smaller producers averaged 6.6%. The difference in earnings growth was even more pronounced. Operating profits from chemicals for the 50 larger companies grew 46% in 1984 compared with just 16% for the group of smaller producers.

The difference between the two groups is somewhat surprising. Although the larger firms are dominated by commodity chemicals, which by their nature are highly dependent on the business cycle, by sometime last year, the smaller producers should have begun to catch up. Add to this the problems that commodity producers have been having with competition from imports, capacity utilization, and pricing, and the difference between the two groups becomes even more important.

The asset base for both groups fell during 1984. Identifiable chemical assets for the 50 larger firms declined an average of 3.1%; for the smaller producers it dropped 10%.

The rise in operating profits for the larger firms was enough to push the average operating profit margin for the 50 larger firms above that for the smaller firms. Chemical operating profit margins (chemical operating profits as a percentage of chemical sales) for those of the 50 larger firms reporting this figure averaged 9.0% compared with an average of 8.6% for the smaller producers.

The 50 smaller chemical companies, however, maintained their lead in return on assets. Those that reported operating profits from both chemicals and chemical assets averaged a return of 14% on identifiable chemical assets, compared with an average of 12% for the 50 largest producers.

For the Top 100 companies, chemical sales increased 7.6% over the year before, and chemical operating profits were up 41%. The average operating profit margin from chemicals was 9.0%, whereas the average return on identifiable chemical assets was 12%. Identifiable chemical assets for the total group fell 4.0% from 1983.

	Top 50	Second 50	Total 100
Chemical sales, change from 1983	7.7%	6.6%	7.6%
Chemical operating profits, change from 1983	45.9	16.1	40.8
Chemical assets, change from 1983	−3.1	−10.0	−4.0
Chemical operating profit margin, 1984	9.0	8.6	9.0
Return on identifiable chemical assets, 1984	12.1	14.3	12.3
	Number of companies on list		
Chemical companies	23	23	46
Petroleum and natural gas producers	13	5	18
Diversified and other	14	22	36
Foreign[a]	5	6	11

a Also included in above categories.

For the first time, except where there were massive reorganizations, companies in the 1984 ranking are compared with their rankings a year ago, instead of rankings based on restated results in the current annual report. Thus, a rise or fall in rank may well reflect acquired or divested chemical businesses as well as increasing or decreasing sales from operations.

For the second year, C&EN ranks the Top 100 chemical producing firms not only by chemical sales, but by chemical operating profits, operating profit margins, chemical assets, and return on chemical assets.

There are some firsts for companies this year as well. General Electric, long known as a large chemical producer, ranked 15, is new to the list this year. This is the first year that GE has reported chemical sales in such a way that it could be ranked. Also new to the list are Avon, ranked 99, and Crompton & Knowles, 98. Two companies, Northwest Industries, ranked 93, and First Mississippi, 96, have reappeared on the list after an absence. In the case of Northwest Industries, the re-emergence is due to revamped reporting methods that break out chemical sales. First Mississippi returns to the list as the result of much higher sales brought about by improved agricultural markets.

Five companies—Gulf Oil, Esmark, Beatrice Cos., Houston Natural Gas, and Martin Marietta—that were on the 1983 list were dropped in 1984, mostly for reasons other than declining sales. The reasons include acquisition by other firms already on the list, divestiture of chemical operations, and changes in reporting methods that do not allow discernment of chemical operating results.

Again, there are a number of large chemical producers not on the Top 100 list because they do not disclose chemical sales. These include such producers as Procter & Gamble and ICI Americas.

There are companies on the Top 100 list that have chemical sales including large amounts of nonchemical products. Examples are Monsanto, Borden, Ethyl Corp., and American Hoechst.

Acquisitions and leveraged buyouts of chemical operations also are playing a big part in changing the makeup of the Top 100 list. Over the past few years, a number of private firms have been formed that probably would be on the list if they were to disclose their sales. These include such firms as Vista Corp. and LCP Industries, both formed from parts of other chemical operations. □